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FREEZE-DEIED POULTRY?
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F-D Report No. 3

In an era of rapid change it is always a problem to assess which changes are important. This is particularly true at present for people in the food industry. Those failing to adapt to innovation will find themselves left behind, sadder and perhaps even wiser.

A successful business is built upon the ability to foresee changes, to understand how these changes are important, and to be able to take advantage of them. A case in point is the new food processing technique called freeze-drying. Will this be important to the poultry industry? What poultry foods can be successfully dried in this manner? How good are they? What are the costs involved? What may be the impact of the new industry upon poultry processors, egg handlers, and poultry producers? Will poultry eating habits change? These questions should be considered when a new food process such as this is introduced.

Before trying to resolve these issues, let's discuss freeze-drying to make sure we understand what is entailed. Freeze-drying is a drying method, not a freezing process. True, the product is frozen, but this is only one step in the drying process. Water is taken out of the food while it is in the solid or frozen state, just as a snowbank will sometimes disappear without melting. The whole operation takes place in a drying chamber in which heat is added to the food while vacuum pumps pull off water vapor. The final product is dried to 2 percent moisture.

Advantages of this method are: (1) If the best known drying techniques are used, most flavor constituents remain in the food; (2) physical structure stays the same so that rehydration is easy and rapid; (3) the

product is storable at room temperatures for about two years; (4) claims are made that it is shipped more economically than frozen or canned food. Thus, many freeze-dried products combine the advantages of satisfactory palatability, hitherto found only in frozen or canned foods, with the economy in shipping, handling, and storing found in dried foods.

A freeze-dried item needs to be tightly packaged to exclude oxygen, moisture, and light. Currently most freeze-dried foods are packaged with an inert gas such as nitrogen. This keeps oxidation to a minimum. Exclusion of oxygen is particularly important, but difficult. The need for a good package is a major problem of the industry today. This problem is accentuated by the fact that many of these foods easily crumble or pulverize.

Before getting on with general statements concerning the way freeze-drying may affect the poultry industry, let's look at research now being conducted by the Department of Agriculture. Presently we are working on several aspects of freeze-drying, and of particular interest are results of tests by our expert taste panel. This panel consisted of five trained tasters. Each product, tasted at three different sittings, was compared with a standard--also replicated three times. The comparison standard, not freeze-dried, was similar to each freeze-dried food under investigation. Each product was judged for flavor, appearance, texture, tenderness, and juiciness. 1/ In addition, each was judged for "general acceptability." This latter attribute, general acceptability, is the only one discussed here.

1/ Complete results of the taste study will be released as a research report by the Marketing Economics Division, Economic Research Service, U. S. Department of Agriculture. Many foods besides poultry products will be included.

Preliminary results of taste tests

Poultry tests included chicken dices served plain, in a salad, and creamed. In addition, chicken stew, chicken rice dinner, chicken noodle soup, and chicken rice soup were also tested as well as scrambled eggs. Comparison standards for the most part were canned or frozen. All poultry products tested had been cooked during the commercial processing.

Figure 1 shows preliminary results of palatability tests for general acceptability. None of the eight freeze-dried poultry products were rated unacceptable. Diced chicken, served plain, was rated "poor" compared with the canned chicken dices that rated between "fair" and "good." When chicken was prepared and tested as a salad, the addition of other ingredients had the effect of raising ratings. This was true for both freeze-dried and canned products. Creamed chicken (made from similar chicken dices) rated between "fair" and "good" for both products being compared.

Chicken stew, freeze-dried, was rated at about midway between "poor" and "fair." The canned comparison product was rated as "good." Freeze-dried and canned chicken noodle soups tested almost the same. This also held true for chicken rice soup. Scores of both soup samples were about midway between "fair" and "good."

Freeze-dried eggs were cooked and scrambled at the processing plants. Compared with the standard, eggs freshly scrambled in the laboratory, they rated "poor." Considering that the standard was made from fresh eggs, the rating is not derogatory.

The general impression of freeze-dried chicken is that by itself it was not so good as the processed standard. However with the addition of other ingredients as in creamed chicken, in soups, and as a salad--palatability improved. Addition of other ingredients and flavorings simulate

PALATABILITY TESTS OF FREEZE-DRIED POULTRY FOODS

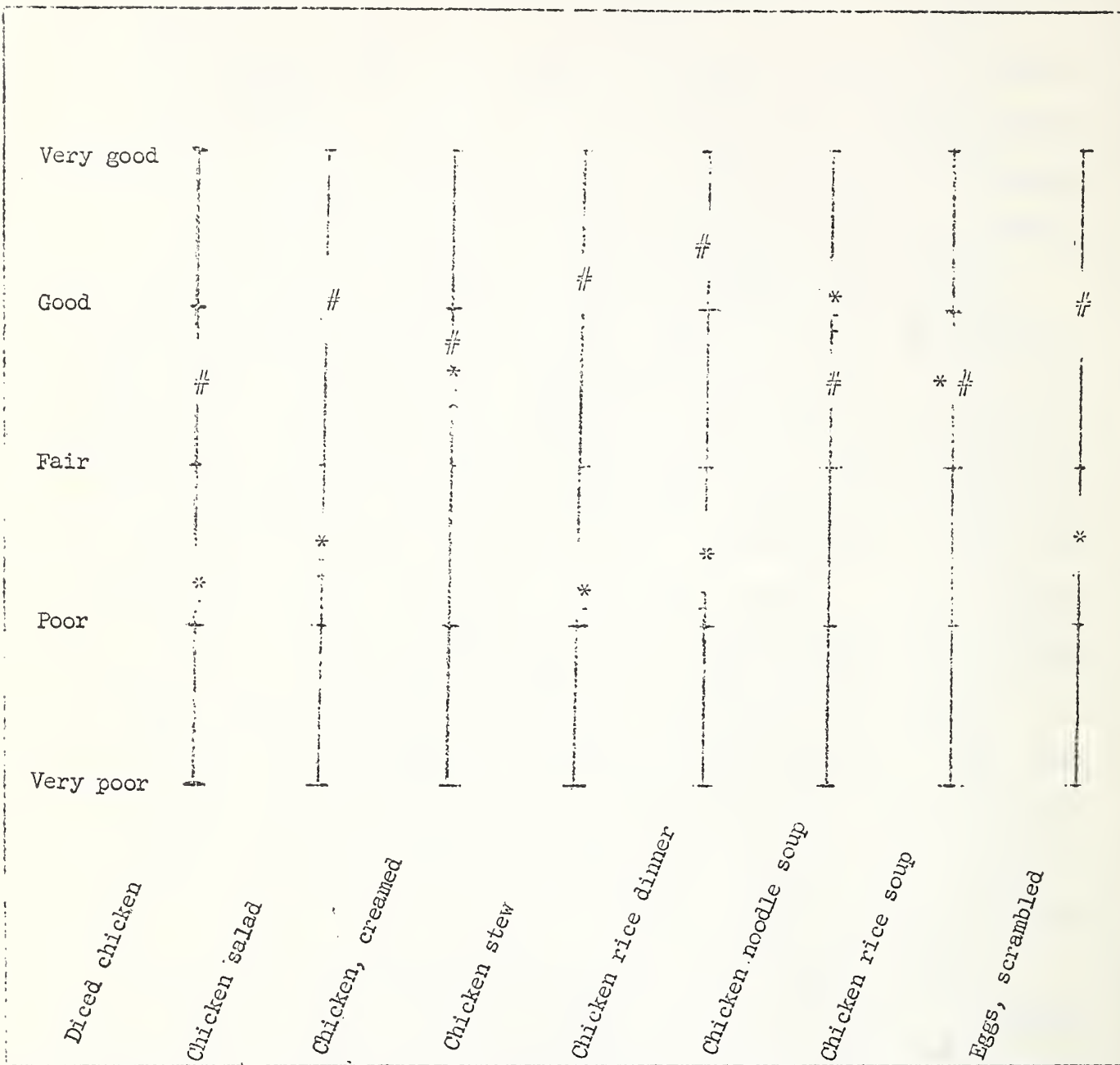


Figure 1.

* - freeze-dried
 # - comparison food

Five trained taste testers sampled each of the foods three different times. Scores shown are averages of the samplings.

usual household cooking conditions and give us a better indication of how these poultry products might be accepted in the market.

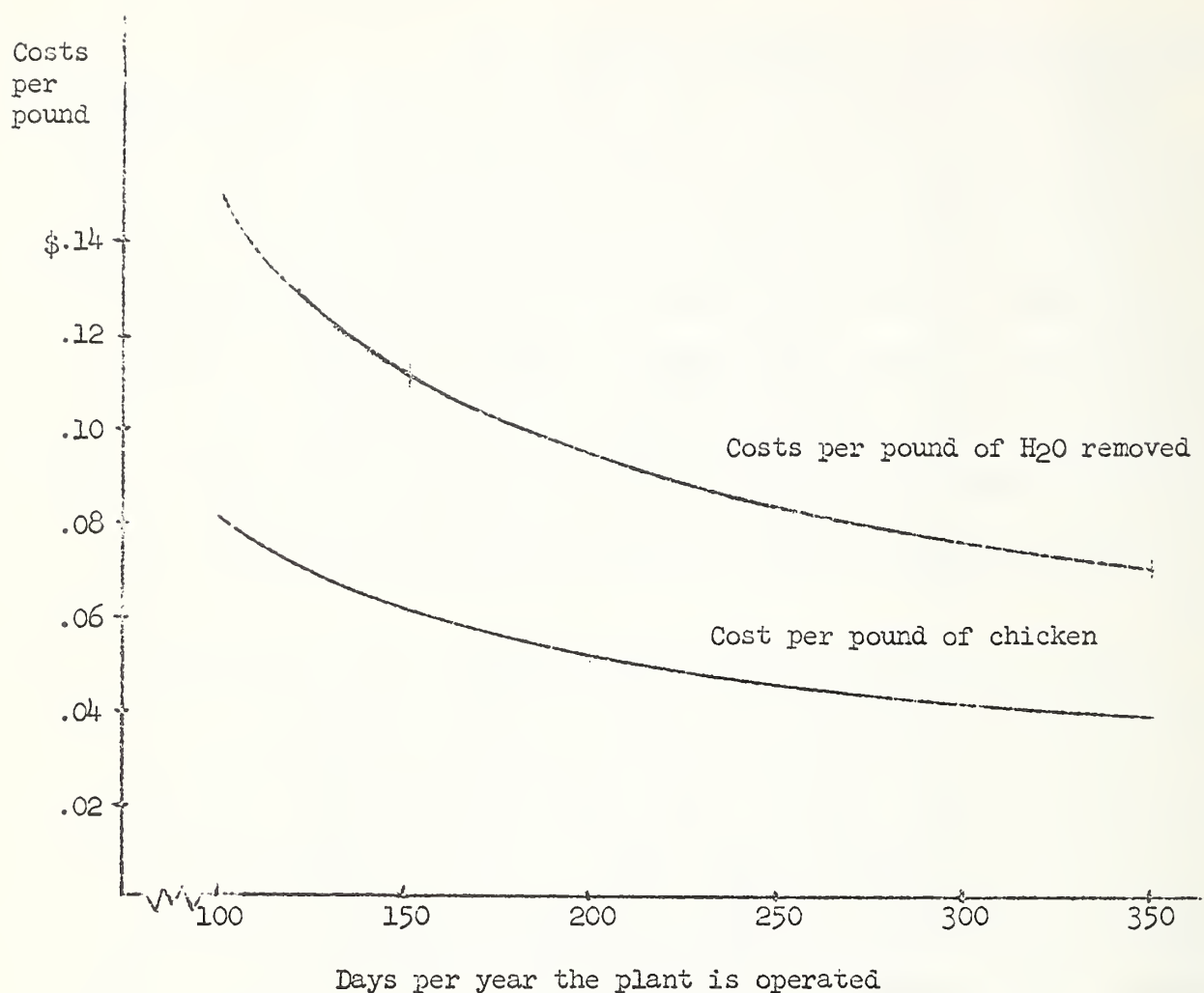
Costs of Freeze-Drying, Preliminary Estimates 2/

Estimates are being made by many people as to costs of freeze-drying. Many of the apparent differences in these estimates arise from the fact that costs are quite variable and calculation methods vary. Important factors to consider are: Moisture percentage of the raw product; assumptions regarding length of drying cycle; length of working day; number of working days per year; level of wages being paid; price of such input items as electricity, steam, and nitrogen; and depreciation rate. Hypothetical cost curves are illustrated in Figure 2 and assumptions are listed below the chart.

Our cost curves show the general level of costs for freeze-drying chicken dices, for a hypothetical plant, operated in a specified way. Costs are shown in two ways--on a "per pound of water removed" basis and on a "per pound of incoming chicken" basis. Costs per pound of water removed are 15 cents when the plant was in operation 100 days per year. The same plant, operated 350 days per year, had costs of 7 cents per pound. Costs per pound of chicken for these same periods of operation were 8 and 4 cents respectively.

Other assumptions could be made that would radically alter the curves. Costs illustrated are for a small plant (water removal capacity of 8000 pounds per day). A plant designed to handle eight times this capacity (64,000 pounds of water per day) and operated 350 days, would have costs of .037 cents per pound of water and .020 cents per pound of chicken.

2/ Complete cost estimates will be released in a research report of the Marketing Economics Division, Economic Research Service, U. S. Department of Agriculture. Costs of other products as beef, mushrooms, and shrimp are included.



Product is cooked chicken dices
 Incoming moisture 56%
 Outgoing moisture 2%

Costs involved are only freeze-drying
 Costs not considered are freezing,
 packaging, storing, warehousing.

Assumptions:

Drying cycle - 12 hrs.
 Working day - 24 hrs.
 Equipment depreciation - 16%/yr.
 Electricity rate - \$.015/KwH
 Steam rate - \$.80/1000 lbs.
 Nitrogen rate - \$.008/cu. ft.
 Capacity - 8000 lbs. H₂O or
 14,815 lbs. chicken/day

Figure 2

Operated at 100 days, this large plant would have costs of 9 and 5 cents respectively.

A changed accounting method also alters costs. As an example, depreciation of freeze-dry equipment is a major expense. We have used a 16-percent depreciation rate for equipment. If the depreciation rate were lowered, costs would also be reduced.

Another way of lowering costs would be to have more drying cycles per day. Our research shows that a ten-hour or an eight-hour cycle lowers costs to a level below the figures quoted.

Currently, freeze-drying costs are high when compared with freezing, canning, or other drying methods. This seriously limits volume potential of this new industry. Nevertheless, this does not minimize the potential for certain products or for special uses of these products. Certainly, freeze-dried eggs or freeze-dried prepared chicken dishes have a market in the 'camping trade. This market is small, though. Good quality dried poultry products such as chicken and turkey dices, pieces, and slices should have a sizeable market for use in soups and prepared dishes. At present, no processor is putting plain freeze-dried poultry meat on grocers' shelves, other than in soups, stews, and camper dishes. Whether a retail market might develop within the foreseeable future is uncertain. If it does develop, it could well be a large one.

How will this new processing technique affect our poultry industry? Will consumer eating habits change? Is this new processing method merely a pipe dream, or will it someday be important to a poultry producer, a processor, egg handler, poultry? Answers to these questions are difficult, since we have so little information we can use for projection purposes. However, there are clues. First, much freeze-dried poultry now on the market is not comparable in quality to frozen, canned or the fresh product.

This would tend to limit its use. On the other hand, when compared with air-dried foods it is superior.

Secondly, because of high costs, it is hard to imagine freeze-dried foods seriously cutting into the retail market for canned, fresh, or frozen fowl, or for eggs. This would be true for domestic as well as export sales. It is also unlikely that eating habits might be changed, for our present processing marketing methods provide a high quality diet at reasonable costs. It is possible, however, that the convenience aspect to the institutional trade might be capitalized upon; and, of course, a big market for these foods is the armed forces. Recently the Quartermaster Corps completed its plans for the "Quick Serve" meal which is composed almost entirely of freeze-dried foods. Eggs and chicken are included in the ration.

How large is this market for poultry? No one has the answer to this one. At present five companies produce freeze-dried chicken meat. One produces freeze-dried eggs. All of these companies have a special use for their products--such as supplying the Quartermaster Corps or other institutional-type buyers. Other uses for the foods are in soup manufacture or in prepared dishes for the camping trade. These companies are large, research-oriented organizations. Their interest indicates that they believe there is now, or will be, a market for freeze-dried poultry. We may expect this market primarily to be in addition to rather than a substitution for present methods of handling poultry. Even though the market is at present a marginal one, we can expect the poultry industry to feel the impact of freeze-drying.

Other copies of this report may be obtained from Kermit Bird, Marketing Economics Division, Economic Research Service, U. S. Department of Agriculture, Washington 25, D. C. Other freeze-dry reports also available are: "Freeze-Dry--Progress and Problems," freeze-dry report No. 1 and "Freeze-Dry Expectations," freeze-dry report No. 2.